# Improved On-demand Routing Protocol in Mobile Ad-hoc Network

*A Thesis Submitted in Partial Fulfillment of the Requirements for*

*The Degree of*

**Bachelor of Technology**

**in**

**Computer Science and Engineering**


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**Under The Guidance of**

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CERTIFICATE

This is to certify that the thesis entitled, **"Improved On-demand Routing Protocol in Mobile Ad-hoc Network "**submitted by **Sundaram Mishra And Abhishek Singh** in partial fulfillment of the requirement for the award of **Bachelor of Technology degree in Computer Science and Engineering** at the National Institute of Technology Rourkela is an authentic work carried out by him under our supervision and guidance. To the best of our knowledge, the matter embodied in the thesis has not been submitted to any other University/ Institute for the award of any degree or diploma.

Place: Rourkela

Date:

Research Guide

Dr. P. M. Khilar

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*Sundaram Mishra*

## ABSTRACT

In mobile ad-Hoc network there is no fixed topology and infrastructure. One of the most important and efficient routing protocol on the basis of energy and number of nodes is AODV distance vector routing protocol source nodes forward In this routing algorithm first it sends the route request (RREQ) to the neighbor with the range of the source and the nodes and then finds the path from one node to another. The intermediate nodes having less energy also forward packets. As the lifetime expires it falls down and the power and energy is not used in the efficient transfer of message and data. It could not forward RREP on reverse path. Hence source node has to restart again and again which results in unnecessary rebroadcast efficiency is less and packet delivery ration is also less and throughput is also less and more end to end delay.

Solution of the above problem in AODV protocol is OAODV routing protocol optimized one in this node does not forward as soon as request (RREQ) reached their first it checked there is a sufficient energy (battery lifetime) and until the node density is greater than the threshold value. These two taking into consideration various statistics . Optimized AODV analyses the energy and node density by avoiding the unnecessary information sending efficiently. By comparing energy ratio and node density it proves that OAODV is much better than AODV protocol on the basis of battery lifetime, throughput, and PDR.

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# CHAPTER 1

## INTRODUCTION

Ad hoc is an infrastructure less wireless networks, there is no any fixed base station Where each node acts as a router as conventional protocols of wired networks are not suitable for wireless ad hoc networks. Hence there is a need for improvement in the routing protocols or infrastructure less wireless network. After that MANET come into existence and become so popular because of its simple and less cost .MANET ad hoc network is a wireless network it consists of mobile nodes connected which operate on battery. These nodes have energy which is decreasing and finite. Therefore needs to conserve the energy to maximize the battery lifetime. Energy management is done by MAC layer while network layer decides the topology and its traffic behavior or characteristics.one of the important characteristics is energy consumed by sleeping nodes is less than that of transmit nodes. For minimizing energy consumed or less power go through the route which consumes less power. One of them is AODV protocol which is a on demand routing protocol which uses less power in compare to other protocols

## MOTIVATION

Due to less number of users, it would not be cost-effective for network service providers to install base-stations to cover all areas. Assuming that an ad hoc

network is used for communication, due to less users the ad hoc network is sparsely populated. Most of the communication in these networks is not time critical in nature and hence some delay can be tolerated. In the above scenario the existing routing protocols for ad hoc networks cannot deliver messages because they always assume a connected path from source to destination. And the schemes which are available to deliver messages in such kind of delay tolerant networks [4] are inappropriate because of the assumptions made by them. Epidemic routing approach [5] assume unlimited capacity of buffer, source and destination are always disconnected, and use a broadcast approach for delivery. Message ferry approach [6] assumes a delivery node named ferry which has predetermined route. Only the ferry nodes are responsible for delivery of data, hence the ferry becomes a single point of failure for the scheme. To communicate over all kind of partially connected ad hoc networks, we need a effective protocol which makes no assumptions about the capability of the nodes or the network. We propose a new protocol proxy-AODV, an extension of AODV, to facilitate communication over such partially connected ad hoc networks.

## PROBLEM IDENTIFICATION

- To find the improved AODV routing protocol in Mobile Ad hoc Network
- To implement the proposed protocol using NS2
- To compare with the existing on demand routing protocol

# LITERATURE REVIEW

## Wireless network

A wireless network is a type of network as computer network that uses wireless for connecting nodes and transferring data. Wireless networking is a method by which we void the costly process of introducing cables and live wires it is used for telecommunication networks and enterprise installation cables and reduces the heavy cost of equipment location. It uses mainly radio communication for implementation and administration. This implementation takes place at the physical layer of OSI model network structure. Wireless network include, Wi-Fi local networks and terrestrial microwave networks.

It uses wireless links some of them as follow:

1) Terrestrial microwave- it uses earth based transmitters and receivers resembling satellite dishes. Which limits communication to line to line spaced approximately 50 km apart
2) Communication satellites- Satellites communicate via microwave radio waves which are not reflected by earths moving and atmosphere. Satellites are placed in space, typically in in its own orbit.

**TYPES OF WIRELESS NETWORKS**

**. WIRELSS PAN**

**. WIRELSS LAN**

**.WIRELESS MESH NETWORK**

**.WIRELESS MAN**

**.WIRELESS WAN**

## Mobile Ad-hoc Network

As the next generation of wireless communication there will be development in the number of mobile users which uses establishing a survivable and dynamic communication for rescue operation. Such network and scenarios uses a wireless network and conceived as application of Mobile Ad Hoc network. A MANET is an is autonomous collection of mobile users that communication with the users without using any fixed topology and pre-defined structure as the network is decentralized, where all network activity includes discovering and maintaining of routes.

The set of application for MANET is diverse, static network , ranging from small that are constrained by power, to high scale , mobile highly dynamic network ad hoc networks. MANETS needs distributed highly efficient algorithm to determine the network organization, linking criteria and power consumption and connectivity and delivering of message and data to the neighboring nodes.

While the shortest and efficient path from source to intermediate nodes and destination in a static network is usually the efficient and optimal route. Factors such as quality of linking and propagation, power expended, and topological

changes become the most important issues. Moreover it uses for military security and preservation of its important documents and security system. As nodes prefer to radiate as less energy as it can and transmit as infrequently as possible, thus decreasing the probability of detection or interception. This is the deciding factor of which routing algorithm is better than the other a lapse of any of these requirements may degrade the ability or performance and efficiency of the network.

## Multipath Multichannel Routing Protocol

Multipath has been proposed for both wired and wireless network. MANETs have two new characteristics other than wired topology of multipath. Nodes have to suffer interference from the nodes surrounded by them because of broadcast nature of dynamic (wireless communication). As a result performance degrades if surrounding nodes transmits the data at the same rates. This problem become serious for multipath routing protocols when nodes simultaneously use multiple paths for transmit packets. Also dynamic topology usually incurs considerable overhead to repair broken links for multipath routing protocol. It selects stable and efficient link to maintain network reliability by removing overload and routing overhead. It is hard to perform optimal load balancing in changing topology because significant overhead has been generated to inform nodes of updating routing table or updating conditions for each path. Multipath mainly focused on how nodes selects multipath to improve the performance and reliability instead of how nodes optimally utilize multiple paths.

The main problem is how nodes select multiple edge-disjoint and node-disjoint and frequency-disjoint paths. Our main focus on the cognitive multi-channel routing protocol multiple disjoint paths are discovered one after another by triggering. A multitude of disjoint multipath routing protocols have been proposed .the main idea is that the nodes select the efficient and non-overlapped path to transmit packets to the destination nodes. On demand uses something like AODV routing protocol but something different from this

## Energy-Aware Algorithm for AODV in Ad-hoc Network

The steps involved in energy aware algorithm are:

Step 1: when any nodes needs to send message or data, it generates a request i.e. Route Request (RREQ) packet and send it to the neighbor with its range

Step 2: The route reply message from the intermediate nodes contains destination address and configuration x and y co-ordinate

Step 3: where each nodes waits for the time maximum waiting time till it receives all the RREP messages destined for the node.

Step 4: Nodes first calculate the distance and the intermediate nodes between source and the destination

Step 5: Now the node with minimum distance choose and routing table is update

With the X and Y coordinate of Hop

Step 6: The transmission energy is calculated using the transmission equation based on distance between the current and next hop. The power threshold of the node is kept constant throughout the process.

Step 7: the route between source and destination is maintained for message for message and data transfer.

# CHAPTER 2

## IMPROVED AODV SCHEME

### Overview of Routing Protocol

ADOV is an ad hoc on demand routing protocol is designed for mobile ad hoc network.it is a both unicast and multicast routing.it builds network only when it is required by source nodes.it maintain routes as soon as it requires the routes. AODV builds routes and discovery is based on the request and reply cycles and its information is stored in all intermediate nodes in the form of routing tables.

There are two packets one is RREQ is a routing request message is broadcast by a node requiring to another node and the other is route reply message (RREP) is unicast back to the node which sends a request message and also a RRER message if there is any error in transmission of message it notify the other nodes of the loss of link. HELLO message is used for detecting the connection and error and monitoring the links to neighbors. AODV maintains rotes as long as the route and

nodes is active. This includes a maintaining a multicast tree for the life of multicast group.

As long as the route is active it will continued to be well maintained. A route is active as long as there is transfer of data and message along the routes from source to destination along the path. Once the source stops sending the data packets, the link will timed out and eventually be deleted from the intermediate node routing tables. If the line breaks but route is still active it sends a RRER request to the source nodes to inform that I am unreachable to the destination. After receiving the RRER request if it stills wants to sends the packets then reinitiates the route discovery and retransmits the data packets.

**The need of Optimization**

Deployment of wireless ad hoc network is increasing day by day to monitor physical environments for everyday applications. The main challenge for ad hoc network is establishment of a reliable network fault tolerant communication channel and able to respond quickly and efficiently to the base station. There is need of measure the energy and power before sending and receiving the packets in AODV routing. If the energy requirement is very high then try the another route and if base station has less energy than that of energy required to reach the destination then don't send the packets because sleeping nodes consumes less energy than that of other nodes. Usually large numbers of micro sensors are used and replacing the battery in many cases is not option thus long system lifetimes are required. Standalone measures like choosing low power sensors are used is not alone sufficient to achieve energy efficiency. There is need of focus on identifying the performance challenges based on the statistical data obtained by

analyzing the different routing protocols used is MANET and there is a need for optimization of the efficient protocol used in wireless sensor network. According to the energy and power basis the AODV is the efficient protocol but it also needs to optimized i.e. before sending request for data packets and receiving packets firsts visualize the routing tables and distance between nodes and destination and calculate the energy before sending the packets and requests.

## Proposed Solution

### AODV route discovery

When the source nodes wants to communicates with the intermediate nodes and the destination nodes then source nodes floods the RREQ i.e. request packets to all its neighbors in the network. This RREQ message contains source and destination nodes IP address, sequence number of destination and current sequence number, hop count and RREQ id. ID is monotonically increasing number. It gets incremented after every initiation of new RREQ.

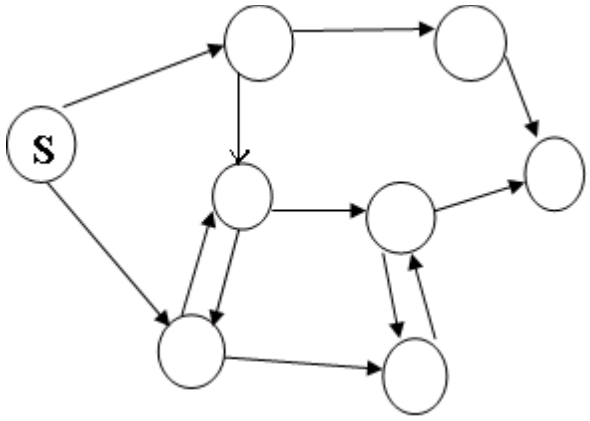



Fig 1: Route discovery

When intermediate node receives RREQ, they create back link to previous node. They first of all check whether route is valid or not. If valid route is found then another operation and condition hold i.e. intermediate nodes sequence number must be at least as destination sequence number in RREQ packets. If both conditions satisfied then node generates the RREP i.e. reply packet. If valid route is not present then RREQ is again sent. As RREQ is forwarded hop count is incremented. While sending packets to nodes start a timer for calculating time if reply doesn't come within that time means there is no more route or link between them.

RREP contains IP address of destination and source nodes and destination sequence number. Once it creates a route entry, it forwards the reply packets to the destination node. RREP is thus forwarded by node and a hop by hop. Once the source receives the RREP it can utilize the path for the transmission of packets.

**AODV Route Maintenance**

As we know MANET is dynamic as its topology and mobility changes and its structure changes from one form to another, linking breaks down and form one another .When breaking of link occurs both the ends inform their ends about breaking of link who were using that link for sending data and Route request i.e. RRER as error message illustrated in fig

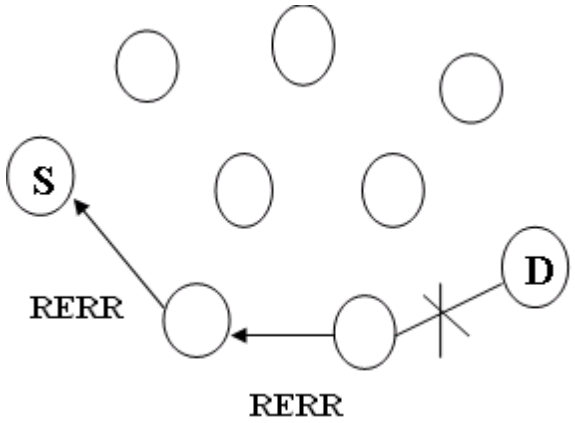



Fig 2: Route Maintenance

As the failure of link end nodes delete their entries from table i.e. routing table as path is no longer useful. As if nodes again want to communicate with the destination then it again initiates and RREQ broadcasting or path finding or repairing of broken link is going on.

**IAODV** (Improved On-demand Routing Protocol)

Each node has a certain amount of energy of battery lifetime and density of nodes in its surrounding which is saved in the table of proposed OAODV protocol. The intermediate nodes not immediately forward the RREQ message immediately if there is route to destination. It will first the energy and lifetime of the nodes and then it calculates the density of its surrounding .Second parameter is taken into consideration because there should be a number of nodes to forward RREQ. As we know Hello message is used to determine the neighbor connectivity of nodes or density. Two values (thresholds) are introduced one is THB for RREQ rebroadcasting and THN for density of nodes in the surrounding of the nodes. If

the lifetime and node density is greater than THB and THN respectively then it concluded that the data can reach the destination with any error or breaking of linking of nodes and so that the intermediate nodes can rebroadcast the RREQ message again. If the value is less than the threshold value then repeat the process again iteratively until either the broadcast is successful or number of attempts exceeds the threshold. This process helps to decrease the unnecessary energy and data broadcasting and it increases the lifetime and throughput.

**Algorithm**

Algorithm for OAODV optimized protocol broadcast

Begin

**Step1**: Initialization of routing parameters like threshold, MAC parameters, sequence number etc.

**Step 2**: Data transmission request

Case: node is not at the destination and there is no path to the destination;

**Step 3**: Repeat the loop till the numbers of tries are less than the maximum number of RREQ request or entries.

{

Increase tries by one in every request;

**Step 4**: Check the battery lifetime of nodes or intermediate nodes;

Calculate the threshold with the help of energy statistics i.e. Brute force method.;

**Step 5**: If battery lifetime is less than the threshold (THB)

**Step 6**: Remain silent and drop the request (RREQ).

Else if count is less than the threshold value (THN)

**Step 7**: Packets are stored in node node's buffer;

Else

RREQ further broadcasted until ends.

}

End

# CHAPTER 3

## SIMULATION RESULTS AND ANALYSIS

Network simulator with 2.34 version of NS2 is used on Ubuntu 10.10 operating system for the simulations. Study of OAODV (optimized) and AODV performed.

### Simulation Tools

Simulation are carried out using the simulation tool Network Simulator-2.the used channel is wireless physical, Mobility model is Random Waypoint model and MAC protocol is 802.11 The simulation setup consists of an area of 1000*1000 with different numbers of nodes for each simulation. All the nodes move in the entire environment. Varying speeds with 2m/s to 40 m/s. packet size is 512 bytes

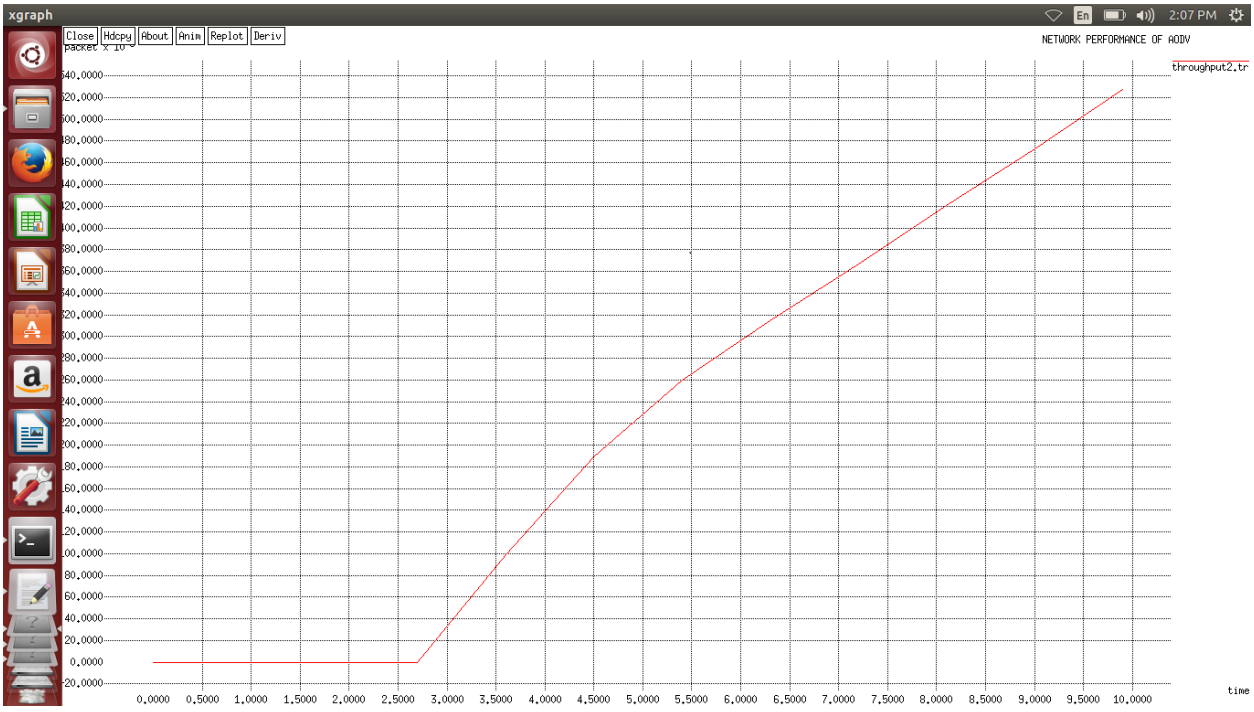
.Different source destination pair have 5-25 connections was used to establish the routes. All the simulations have maximum period. Have initial energy of 100 j for each node with power transmission and reception power of 5 and 1 respectively.

**Simulation parameters**

| Parameter | Value |
|---|---|
| Number of nodes | 71 |
| Grid Area | 1200x1200 |
| No of connections | 50 % |
| Pause time | 0sec |
| Speed | 5m/s,10 m/s,40m/s |
| Traffic Model | CBR |
| Data Packet size | 512 bytes |
| Data packet interval | 4 packets/sec |
| Simulation Time | 10sec |
| Initial Energy | 100J |
| Transmission Power | 5W |

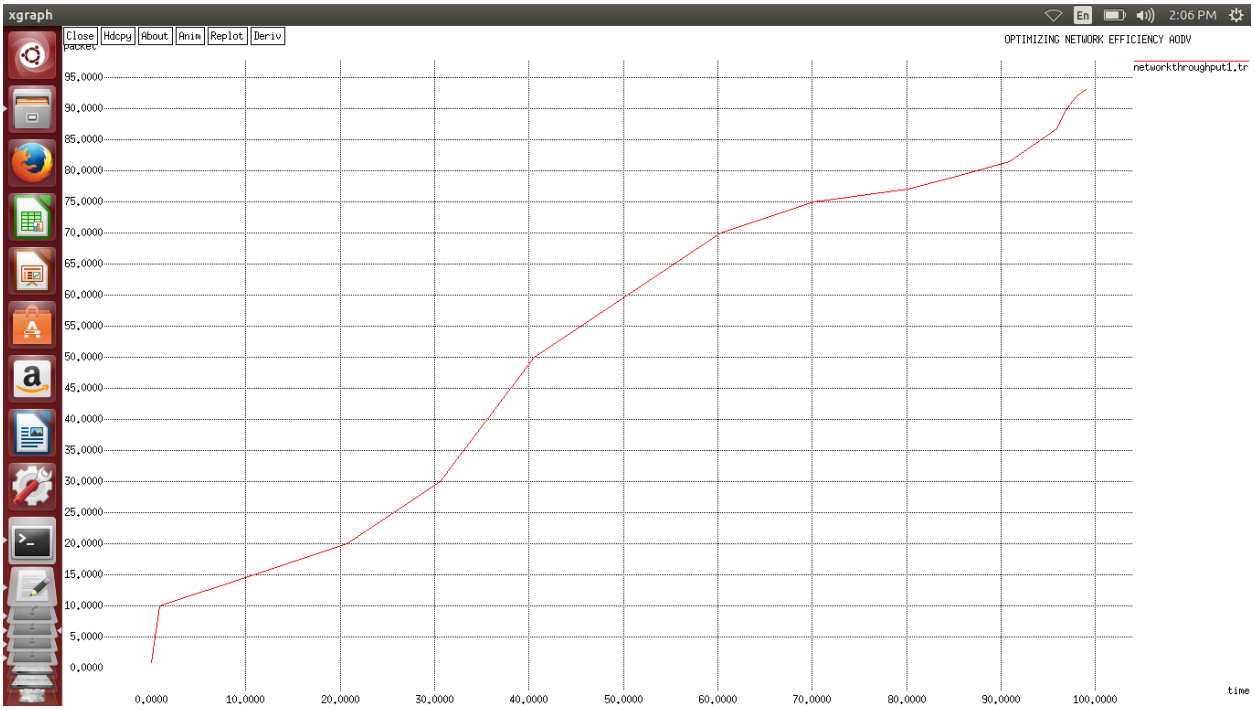
# Simulation and results

## AODV



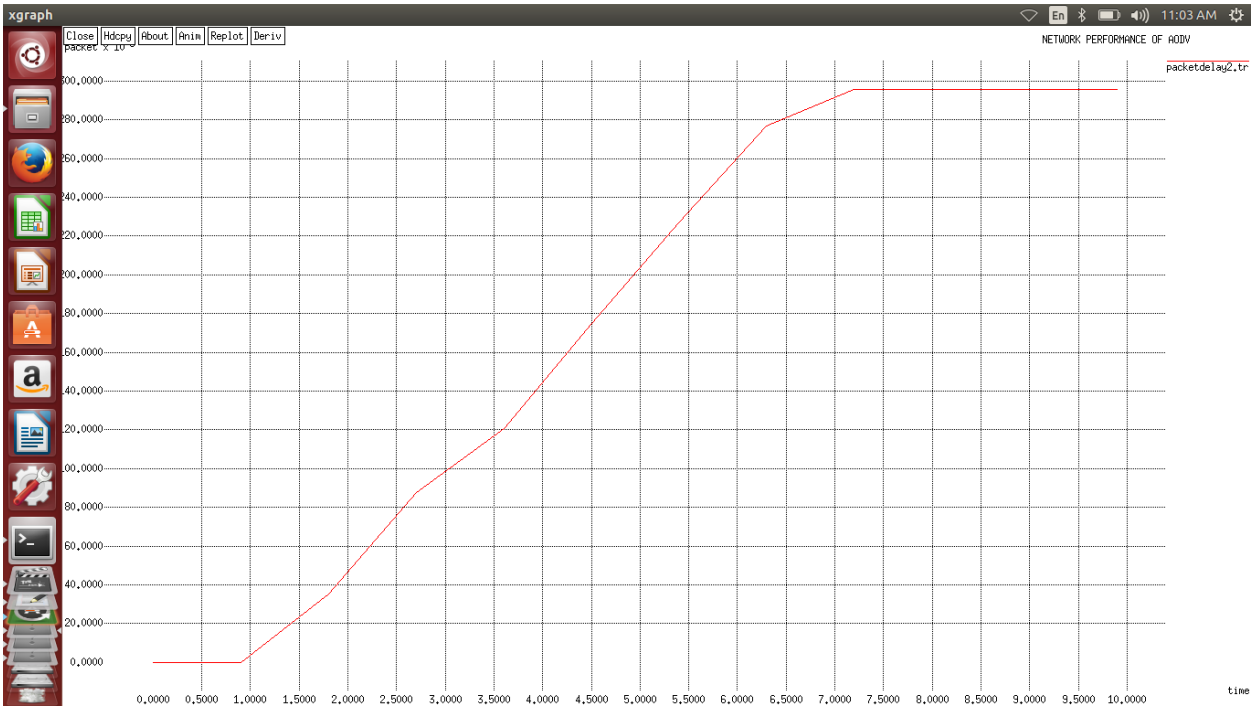

Throughput Vs time

# IAODV



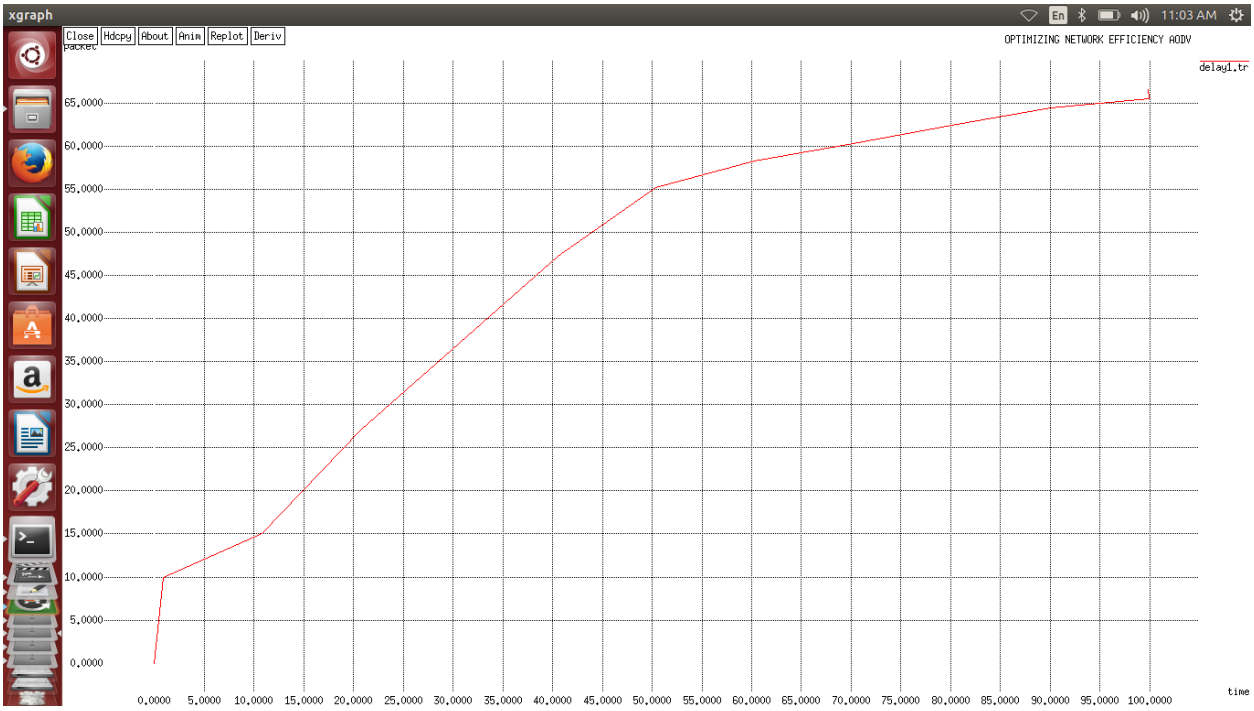

Throughput Vs time

# AODV



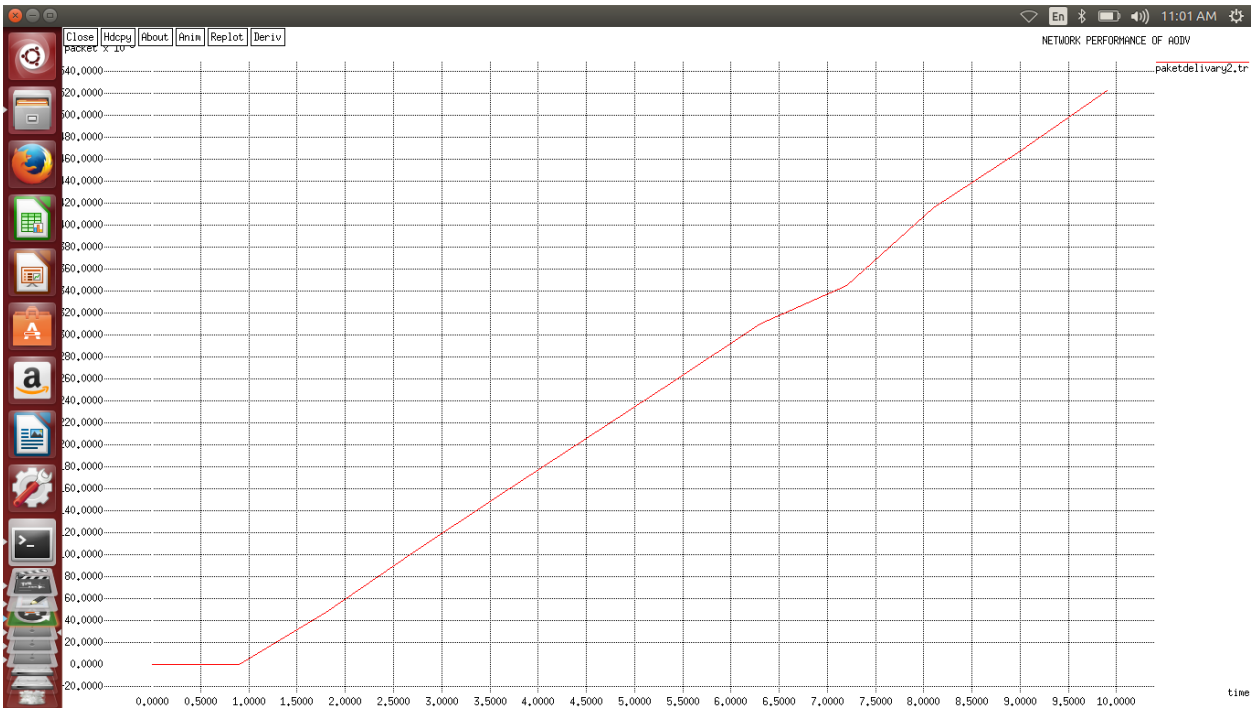

Packet delay Vs time

# IAODV



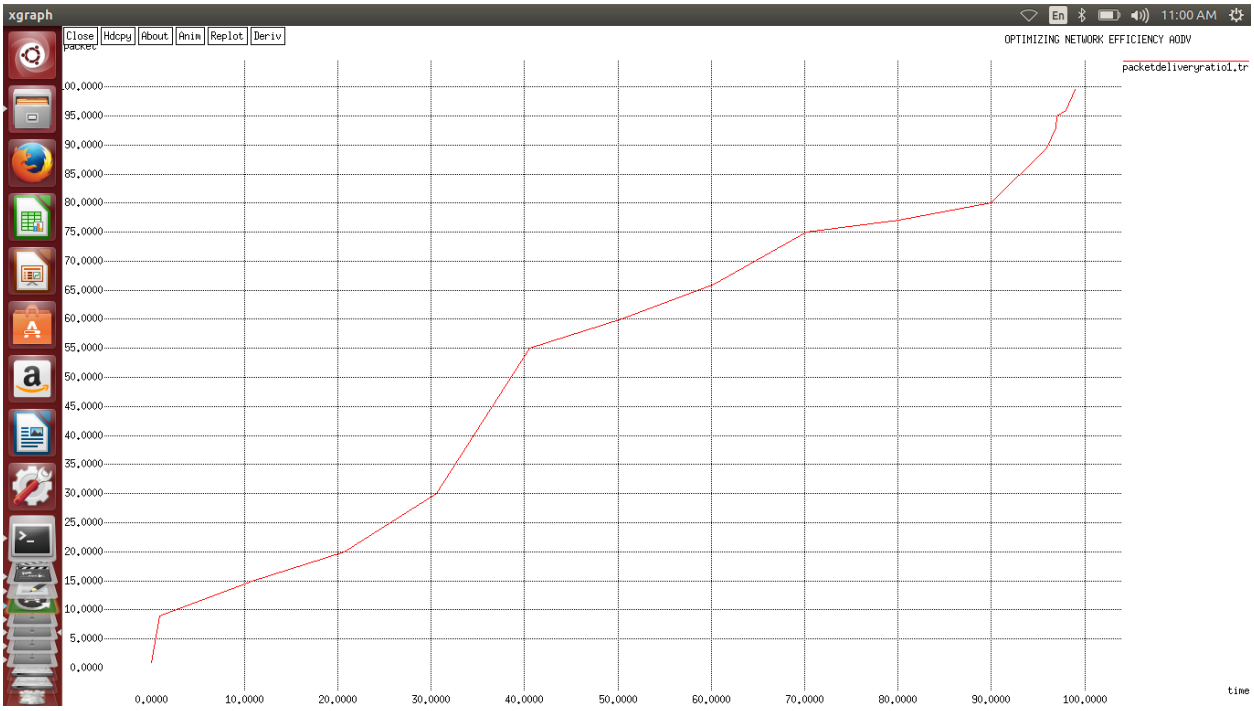

Packet delay Vs time

# AODV




Packet delivery Vs time

# IAODV




Packet delivery Vs time

**Result**

Comparison of AODV and Optimized AODV in terms of throughput

## **IAODV** (throughput)

| Time | throughput |
|---|---|
| 0 | 0.01 |
| 0.90000000000000002 | 10 |
| 10.8 | 15 |
| 20.7000000000000002 | 20 |
| 30.6000000000000001 | 30 |
| 40.5 | 50 |
| 50.4000000000000004 | 60 |
| 60.3000000000000007 | 70 |
| 70.2000000000000011 | 75 |
| 80.1000000000000014 | 77 |
| 85.0000000000000018 | 79 |
| 90.9000000000000021 | 81.5 |
| 95.9000000000000021 | 86.7 |
| 97 | 90 |
| 98 | 92 |

## **AODV** (throughput)

| Time | throughput |
|---|---|
| 0 | 0.0 |
| 0.90000000000000002 | 0.0 |
| 1.8 | 0.0 |
| 2.7000000000000002 | 0.0 |
| 3.6000000000000001 | 0.09 |
| 4.5 | 0.18 |
| 5.4000000000000004 | 0.26 |
| 6.3000000000000007 | 0.31 |
| 7.2000000000000011 | 0.36 |
| 8.1000000000000014 | 0.42 |
| 9.0000000000000018 | 0.47 |
| 9.9000000000000021 | 0.52 |

## CONCLUSION AND FUTURE SCOPE

This work discusses how energy is one of the important factor for MANET. Energy efficient AODV routing protocol is proposed. This paper presented an Optimized Mobile Ad Hoc Network on Demand routing protocol, which modifies broadcast mechanism of conventional AODV routing protocol. Successful delivery of RREP is important in MANET. If reply is lost, new rote discovery process has to be reinitiated. IAODV avoids unnecessary broadcasting of RREQ information. In this proposal, the node does not broadcast the routing request (RREQ) if it does not have sufficient energy (battery lifetime), and until the node density in its surrounding exceeds a particular threshold. After comparing AODV with OAODV in terms of battery lifetime and throughput, it is observed that the new protocol is much better than AODV and lengthens the battery lifetime

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